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TECHNICAL NOTE

A Simple Technique to Assist in the Repair of Thoracoabdominal Aneurysms

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The major problem in repairing thoracoabdominal aneurysms is the mortality and morbidity resulting from ischaemia to vital organs such as the liver, bowel and kidneys. This can result in renal failure or death from systemic toxicity due to the release of cytokines leading to respiratory distress syndrome and multi organ failure.[1] Paraplegia is also a problem in these patients and its incidence varies with the type of aneurysm being dealt with.[2]

Several techniques have been suggested to minimise the adverse effects of clamping the aorta above these vital organs. The original technique described by Crawford, the so-called "clamp and go technique", required a rapid implantation of the various vessels which inevitably resulted in ischaemia, technical difficulties and the problems mentioned earlier.[3]

Another technique has been to retrogradely perfuse the aorta via a femoral artery using a pump. Blood is taken either from the aorta above the clamp or the left atrium and pumped into the femoral artery. Alternatively blood can be pumped from the femoral vein to the femoral artery via an oxygenator. The temperature is reduced to 32°C and a low dose (1 mg/kg) of heparin used. The aorta is clamped above the sac and at the upper end of the aneurysm while the proximal anastomosis is performed. This allows retrograde perfusion of the vital organs and intercostal vessels, minimising the effects of ischaemia. The clamp is then moved lower and placed above the coeliac axis and the intercostal vessels attached to the graft. Meanwhile the coeliac axis, superior mesenteric artery and the renal arteries are still retrogradely perfused. Finally, a clamp is placed across the graft below the intercostals and the upper clamp release to revascularise these vessels. The coeliac, superior mesenteric and renal arteries are then separately perfused with a so-called octopus catheter.[4] Throughout the procedure cerebrospinal fluid is continually drained from the spine to keep the pressure at 10 mmHg.

Another technique to achieve retrograde perfusion without the use of a pump and heparinisation is the insertion of an axillo-uni-femoral graft to achieve the same result.[5] A fourth possibility is to put the patient on bypass, cool them and do the procedure with cardiac arrest and a bloodless field using trasolol to avoid the effects of anticoagulation.[6]

All of these techniques have advantages and disadvantages, and a simple technique particularly useful in type III and type IV aneurysms can avoid many of them. The method involves the suture of a 10 mm dacron graft to the right axillary artery while the aneurysm is being exposed through an appropriate (usually thoracoabdominal) incision. The 10 mm dacron graft will stretch to the abdominal cavity across the chest and a heparin bonded catheter (Baxter) can be tied into the end of it. Two Pruitt shunts are attached to the Y piece of the tubing and four possible perfusion arms and are then available. This is all done prior to clamping the aorta above the aneurysm. The patient is not heparinised. When all is ready the aorta is clamped, the sac opened and the four Pruitt shunts inserted into the superior mesenteric artery, the coeliac axis and the two renal arteries, allowing these organs to be perfused from the right axillary artery. This also downloads the heart and also allows a good circulation to the organs. After this has been done the lumbar vessels are oversewn and the graft then anastomosed to the aorta above the sac. If it is a type IV aneurysm the intercostal arteries do not usually need to be attached to the graft, but if it is a type III a patent vessel should be attached to the graft before the clamp is placed below this patch and the upper clamp

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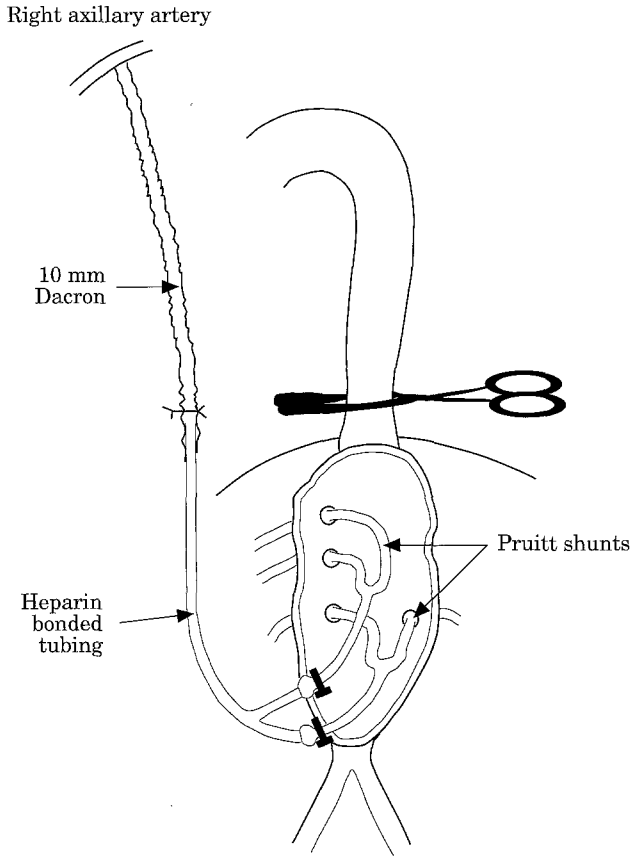

Fig. 1. Organ perfusion using a temporary axillary Dacron graft in thoracoabdominal aneurysm repair. The balloon tubing has been omitted from the Pruitt shunts for clarity.

released to revascularise the intercostal vessels. Meanwhile the main organs are being perfused (Fig. 1). It is necessary to place a sling round each vessel and put it on slight tension proximal to the inflated balloon to prevent the shunt slipping out. There is no need to rush the procedure and the other vessels can be sewn on consecutively. Usually the superior mesenteric and coeliac arteries can be attached by a single patch, sometimes with the right renal artery, which otherwise requires to be attached separately.

As each patch is attached the Pruitt shunt is removed and the clamp is placed below that level on the graft and these vessels are revascularised until all four branches have been reattached and the bowel, liver and kidneys reperfused. The lower end of the graft can then be sutured to the aorta or iliac vessels. Lastly the axillary artery can be reconstituted by simply cutting the graft off and oversewing the stump, leaving a cuff of dacron attached to the artery.

For type II lesions and for some type III aneurysms, retrograde perfusion of the intercostal vessels using a pump while the proximal anastomosis is being done is still necessary. It may in future be possible to obtain smaller catheters which will allow perfusion of the intercostal vessels as well.

This technique has been used in our hands in five patients, all of whom achieved immediate renal function after the procedure and had no evidence of systemic inflammation or organ failure. This technique allows a relatively slow and considered approach to the operation without the need for the haste engendered by "the clamp and go technique". In addition, complicated pumps and technical support are rarely required.

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